Curriculum S.19
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ONTARIO

Department of Education

COURSES OF STUDY

GRADES 11 AND 12

INDUSTRIAL ARTS

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COURSE OF STUDY IN INDUSTRIAL ARTS

GRADES 11 AND 12

Aims

1. To develop the student's ability to solve problems by means of analysis, planning, and construction of useful objects of good design.
2. To help the student to become a useful member of his family and his working group in society through the development of wholesome attitudes towards work and workers.
3. To promote understanding and appreciation of the importance of industry in modern life by developing the student's mechanical knowledge, interests, and skills.
4. To train students so that they may become more intelligent consumers and producers of industrial products and services.

General Suggestions

1. A suitable selection of topics within the activities offered should be made by the instructor from the prescribed Course of Study in accordance with the needs of the community.
2. Allocation of time to each activity should be flexible and should be determined by the problems selected by students; however, some time should be spent in each activity. Reasonable guidance by the instructor should prevent congestion of pupils in any one activity area of the shop.
3. Projects should present real problems rather than artificial situations and should be designed, planned, and executed by the students. Group participation in a group project should be encouraged. Projects should be such that they can be completed in one year.
4. It is suggested that any selected problem be such that it involves as many of the shop activities as possible.
5. The plan of the Industrial Arts room necessitates simultaneous instruction in a number of varied activities. Well organized Industrial Arts libraries, containing illustrative materials and other lesson aids, will offer valuable assistance to instruction and general administration. Tools and other equipment should be properly stored in cabinets provided for the purpose and made readily accessible to the pupils as required.
6. The student, in conjunction with the instructor, should appraise his analysis, planning, performance, and attitudes. Records of such appraisals should be made promptly and regularly.
7. Dangerous conditions affecting the health and safety of the pupils must be avoided. Exhaust gases from operating engines, fumes from heat-treating processes, and the like, must be effectively discharged. All machines must be properly guarded; safety instruction must be given wherever hazards exist. First-aid treatment must be readily accessible. A clean and well-appointed Industrial Arts room with the equipment maintained in first-class

operating condition is an important factor in the prevention of accidents.

8. It is the duty of the instructor to train the students in good work habits (such as sweeping down benches, keeping tools and cupboards in condition), but it is not his duty to perform such janitor services as cleaning floors and windows, or dusting the classroom.

9. Integration of Industrial Arts with related facts and processes in Social Studies, Mathematics, English and other subjects should be introduced wherever possible.

Reference Books

Books for the assistance of the teacher and the pupils have been listed under the divisions to which they are particularly related. Those marked (#) may be borrowed for a period of two weeks upon application to the Inspector of Industrial Arts, Department of Education. Those marked (o) may be obtained for a similar period on application to the Librarian, Legislative Library, Parliament Buildings, Toronto.

Some general reference books are listed below.

#Wilbur: Industrial Arts in General Education. General.
#Ericson: Teaching the Industrial Arts. Copp Clark.
Jackey and Barlow: The Craftsman Prepares to Teach. Macmillan.
#Newkirk: Organizing and Teaching the General Shop. Copp Clark.
o Pratt: I Learned from Children. Musson.
Ashcroft and Easton: General Shop. Macmillan.
Cook, Scranton and McColly: Farm Mechanics. Interstate Publishers, Danville, Ill.
Groneman and Feirer: General Shop. McGraw-Hill.

COURSE OUTLINES

Applied Machinery Mechanics

This course is particularly desirable for classes of rural and agricultural areas. The chief objective of teaching Applied Machinery Mechanics is to acquaint the student with the general mechanical principles involved in machines commonly used in the community. The practical application of this course should provide the student an opportunity to repair existing machines and to plan and construct simple machines.

Grades 11 and 12

This course will be a direct continuation of the work of previous grades, with the following additions:

Internal Combustion Engines

(1) The 2 and 4-stroke-cycle single-cylinder engines.
  (a) Operating principles of 2 and 4-stroke-cycle internal combustion engines.

(b) Relation of stroke to throw.
(c) Valves—function of simple types of valves.
(d) Timing
    (i) ignition
    (ii) valve.
(e) Lubrication systems
    (i) full-force type
    (ii) splash-and-force type.
(f) Cooling systems and attached auxiliary units.
(g) Fuel systems.
(h) Electrical systems—the function of the
    (i) battery
    (ii) starter-generator
    (iii) ignition, circuits, and timing.

(2) Safety is to be stressed with respect to the following:
(a) danger of products of combustion such as carbon monoxide;
(b) rules and regulations of the Ontario Traffic Act;
(c) water safety and rules for boating;
(d) mechanical hazards;
(e) fire hazards.

Reference Books

o Fairies: Design of Machine Elements. Macmillan.
Berard and Waters: Machine Design. Van Nostrand.
Pamphlets in regard to the internal combustion engine may be obtained from various manufacturers.

Drafting and Blueprint Reading

Drafting should take the form of Planning and Blueprint Reading.
Note: Symbols should be taught as the necessity for them arises.

Grade 11

Study of detail and assembly drawings of projects which may be made in or about the shop.
Study of thread types and thread symbols.
Study of fundamentals of building construction in relation to small frame buildings such as poultry houses and range shelters.
Study of pattern development using parallel and radial line methods.

Grade 12

Simple triangulation, such as an oil or gasoline pouring can.
Isometric drawings, including the principles of straight lines and circles.
Fundamentals of Architectural Drawing.

Reference Books

Giesecke, Mitchell and Spencer; Technical Drawing. Macmillan.
French and Svensen: Mechanical Drawing. McGraw-Hill.
French and Vierck: Engineering Drawing. McGraw-Hill.
Mattongly and Scroggin: Applied Drawing and Design. Copp Clark.

Electricity

Aim

The aim of this course is to instruct the pupil, as a future householder, in the fundamentals of consumer electricity. In Grades 9 and 10 the student has dealt with Direct Current voltages up to approximately 24 volts. It is expected that the student in Grades 11 and 12 will become familiar with single phase alternating current voltages up to 120 volts.

Grade 11

1. Practice in the use of meters and measuring devices in determining specific characteristics of electrical appliances common to home or farm — voltage, current, power speed, and normal temperature rise.

2. Interpretation of name-plate data in understanding charactistics of electrical appliances common to the home.

3. Utilization of data in 1. and 2. in planning and understanding installations, over-load protection, and fusing of circuits for various home electrical appliances or groups of appliances.

Grade 12

1. Basic understanding of the C.S.A. or Ontario Hydro Electric Commission electrical code with respect to installations with which the student may come in contact within the home.

Notes

1. Electrical safety as it applies to single phase circuits up to 120 volts to ground must be stressed—
   (a) purpose of grounding
   (b) the function of the grounded neutral
   (c) grounding of appliances.

2. Care should be taken to correlate this course with the electricity of the Science course.

3. Opportunity should be given to the students to do individual study with respect to the use and importance of electricity and electrical devices in the home and the community, such as automatic doors, automatic signals, and automatic timers.

Reference Books

McDougal, Dunlap and Ranson: Fundamentals of Electricity. General Publishers.
Perry and Schafebook: Fundamental Jobs in Electricity. McGraw-Hill.

Marcus and Horton: Elements of Radio. Prentice Hall.
Watson, Welsh and Eby: Understanding Radio. McGraw-Hill.

General Metals

Activities

1. Art Metal
2. Forge and Ornamental Iron
3. Machine Metalworking
4. Sheet Metal
5. Welding

Each of the above may be taught as an activity in its entirety, or selected topics from any or each may be combined to form other activity units.

Reference Books

Feirer: General Metals. McGraw-Hill.
Ludwig: Metalwork Technology and Practice. McKnight-McKnight

Art Metal

Grades 11 and 12

This course is planned to develop good artistic design in suitable projects through the manipulation and fabrication of copper, pewter, German silver, sterling, and other metals.
Opportunity should be given to the student to study projects of good design which will contribute to his appreciation and good taste.
As a supplement to the above course, gem cutting, polishing, and setting may be introduced.

Reference Books

Varnum: Industrial Arts Design. Manual Arts Press—Copp Clark.
Osburn: Constructive Design. Bruce Publishing Company—Ryerson Press.
Hunt: Indian Silversmithing. Bruce Publishing Company—Ryerson Press.
Whitlock: The Story of the Gems. Emerson Book Inc., New York.
Feirer: Modern Metalcraft. Manual Arts Press—Copp Clark.

Forge Work and Ornamental Iron

Grade 11

Emphasis should be placed on planning and making the necessary full-size drawings.

1. **Materials**—cold-rolled and hot-rolled mild steel in various form.
2. **Tools**—those necessary to perform such operations as forming, twisting (hot and cold), use of chisels for veining, peining, making and using scrolls, forming leaves, texturing, finishing.

Grade 12

Emphasis should be on principles of design and the designing by students of the projects to be made during the year. For this purpose the information and processes of all previous grades should be utilized. Pipe or tube work may be introduced. Correlation with other materials and activities is desirable.

Reference Books

Bollinger: Elementary Wrought Iron. Ryerson.
Bick: Artistic Metal Work. Ryerson.
Smith: Units in Forging and Welding. Moyer.
Harcourt: Elementary Forge Practice. Copp Clark.

Machine Metalworking

Grades 11 and 12

The work of Grades 11 and 12 should consist of problems involving practice with those types and classes of metalworking machines found in the community and with information, processes, and materials commonly used in the machine-tool and metal-consumer industries and businesses with which the students are familiar.

The students should select, plan, and solve their problems with reasonable guidance by the instructor. Encouragement and direction in the process of research should form an important phase of the course, particularly as it applies to related information.

Reference Books

Burghardt: Machine Tool Operation. McGraw-Hill.
Schuman: Machine Shop Work. General Publishers.
Machinery's Handbook. General Publishers.
Wagner and Arthur: Machine Shop Theory and Practice. Van Nostrand.
Lathe operation and Machinist's Tables as published by manufacturers of reliable equipment.

Sheet Metal

Grades 11 and 12

Emphasis should be placed on practical projects which involve experiences in layout and development using parallel line, radial line, and triangulation methods, and incorporating the use of combination machine and beading and crimping. Silver soldering and brazing may be used as methods of joining or fastening. Special seams, such as Pittsburg lock and "S" slip, should be utilized.

Reference Books

Hedley: Basis of Sheet Metal Drafting. Longmans.
Williams: New Tinsmith's Helper and Pattern Book. General Publishing Co.

Dickson: Geometry of Sheet Metal Work. Pitman.
Daugherty: Sheet Metal Pattern Drafting and Shop Problems. Manual Arts Press.

Welding

Grades 11 and 12

It is recommended that welding be not treated as a separate unit, but that it be integrated with the other metal-working activities at this level, and that welding processes be considered by the student in his design, planning, and execution of the projects in the other metal-working activities.
The work in these grades should include experience in welding and/or brazing non-ferrous metals and cast iron.
Information relative to the equipment, materials, and processes used up to and in this grade should form an important phase of the work.
Note: Where electric welding equipment is available, the course should be adapted to include this type of welding.

Reference Books

Groneman: Elementary and Applied Welding. Ryerson.
Linde: The Oxygen Acetylene Handbook. Dominion Oxygen Co.
Kugler: Arc Welding Lessons for School and Home Shop. Lincoln Electric Co., Toronto 17.

Lapidary Work

Grades 11 and 12

Sources of supply for raw materials.
Recognition of type stones in the Feldspar and Quartz groups. Introduction to classification of gem materials by crystal system, type of fracture, specific gravity, colour, hardness (Mohs' Scale of Hardness). Short sketches on occurrence, characteristics, and properties of a number of precious stones and semi-precious stones. Short study of abrasives—varieties, bonding, manufacture.
Cabochon cutting with semi-precious stones.
Introduction to faceting.
Building and setting up of equipment used in lapidary work, with emphasis on simplicity of design and potential hobby value to the individual. (Building of equipment might well include pattern making, casting, and machine shop work in schools so equipped).
Correlation with Art Metal course for appropriate settings.
The making of small castings in silver using cuttle bone or any simple method.
Note: 1. Special safety factors of this activity should be stressed.
2. Some localities are especially well situated for field excursion or a visit to a local industry; for example, marble and mosaic, art glass, tombstone works, custom jewellery manufacture, quarrying, mining, or museum.

Reference Books

Feirer: General Metals. McGraw-Hill.
Baxter: Jewellery, Gem Cutting and Metal Craft. Copp Clark.
Howard: Revised Lapidary Handbook.
Weiner: Handmade Jewellery. McClelland.

Woodwork

Part I, Bench and Machine

Grades 11 and 12

To the experiences gained in previous Grades will be added those which will assist pupils of Grades 11 and 12 to obtain broader development of skills and interests through desirable activities in the fabrication of wood projects. Advantages must be taken of students' ingenuity and planning with increased emphasis on the principles of good design including beauty and function.
This course should make use of the modern trends in tools, machinery, materials and methods employed by industry and science.

Reference Books

Gottshall: How to Design Period Furniture. Bruce Publishing Co.—Ryerson Press.
Groneman: General Woodworking. McGraw-Hill.
Hjorth: Principles of Woodworking. Bruce Publishing Co.—Ryerson Press.
Vanderwalker: Wood Finishings. Drake Publishing Co.—General Publishing Co.
Osburn: Constructive Design. Bruce Publishing Co.—Ryerson Press.

Part II, Building Construction

Grades 11 and 12

Because of the wide variety of accommodations for Industrial Arts throughout the province and because of the variation in time allotment for Industrial Arts in different centres, it must always be kept in mind that any course suggested is intended only as a framework on which the instructor may build to suit his own situation.
In a course in Building Construction the project is a means to an end. The construction of a finished or semi-finished building will provide many building experiences for all students participating as well as an incentive toward learning and pride in a job well done.

Reference Books

Townsend: The Steel Square. American Technical Society—General Publishing Co., 17 Queen East, Toronto.
Townsend: Carpentry. American Technical Society—General Publishing Company.
Lair: Carpentry for the Building Trades. McGraw-Hill.
National Housing Act, 1944: Building Standards. Central Mortgage and Housing Corporation, Ottawa.